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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/541,970	07/11/2005	Alix Helene Gicquel	05-583	8766

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EXAMINER	
STOUFFER, KELLY M	

ART UNIT	PAPER NUMBER
1762	

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08/16/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/541,970	GICQUEL ET AL.	
	Examiner	Art Unit	
	Kelly Stouffer	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3 July 2007 has been entered.

Response to Arguments

2. Because a new Oath/Declaration has not yet been filed, the objection to the Oath/Declaration of the previous Office Action is maintained and repeated here in its entirety.

3. Applicant's arguments filed 3 July 2007 with regard to the 35 USC 102(b) and 103(a) rejections using Chow have been fully considered but they are not persuasive. The applicant argues that Chow does not disclose a periodic pulsed discharge that forms a repeated succession of low and high power states. However, Chow utilizes microwave energy to form the discharge (abstract). Microwave energy is a type of electromagnetic radiation with a specific frequency range and wavelength range. The frequency of high and low energy states of microwave radiation easily translates into

periodic series of high and low energy states (frequency=cycles per amount time, period=amount of time per cycle) that is a periodic pulsed discharge with a repeated succession of high and low power states when applied to a plasma. As such, the examiner maintains that Chow discloses a periodic pulsed discharge that forms a repeated succession of low and high power states. The rejections of the claims under Chow are thus maintained and are repeated here in their entirety.

Oath/Declaration

4. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:

The declaration is in French. Please translate declaration to English.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 3, and 5-8 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent number 5240749 to Chow.

Chow discloses a method for synthesizing diamond films that includes pulsed microwave plasma described in column 2 lines 56-68 in a vacuum chamber 10 in figure 2. Plasma 75 in Figures 3-5 of a finite volume as described in column 2 lines 5-57 is formed near a substrate 15 in Figures 2-5. The plasma 75 is formed from hydrogen and methane gases as described in column 2 line 51 Chow utilizes microwave energy to form the discharge (abstract). Microwave energy is a type of electromagnetic radiation with a specific frequency range and wavelength range. The frequency of high and low energy states of microwave radiation easily translates into periodic series of high and low energy states (frequency=cycles per amount time, period=amount of time per cycle) that is a periodic pulsed discharge with a repeated succession of high and low power states when applied to a plasma. The peak absorbed power that generates carbon radicals is broadly included in the disclosure of Chow because the plasma by definition (see Blinov et al. column 3 lines 53-62 cited previously) contains radicals and must have reached a peak power to form said radicals. The plasma 75 containing radicals forms a diamond film 85 in Figures 4 and 5 thereon. The applicant claims that the plasma must have a peak power density of greater than 100 W/cm^3 while maintaining a substrate temperature of between 700-1000 °C. Chow discloses a substrate temperature within the range of 680-750 °C described in column 4 lines 13-14 and power densities of 600 and 1000 W/cm^3 described in column 5 line 50 and line 63, respectively. Chow meets the recitations in claim 1, at least as broadly recited in claim 1, for a method for manufacturing a diamond film.

With regard to claim 3, Chow discloses the gas used to create the plasma as 1.5 % methane in a hydrogen gas environment in column 4, lines 1-4. This meets the recitation in claim 3 that the gas containing hydrogen and carbon must have a molar ratio of between 1-12 % at least as broadly recited in the claim.

With regard to claim 5, the ratio of time from the low to high power state is one in claims 3-4 of Chow.

With regard to claims 7 and 8, the plasma is contained within the cavity shown in Figure 5 of Chow and the pressure falls within the claimed ranges in column 4 lines 15-20.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyanaga et al. (US 5626922).

As to claim 1, Miyanaga et al. discloses plasma CVD method using a pulsed microwave plasma to deposit a diamond film (abstract and examples). There is a peak power in order to deposit the film in column 3 et seq., and this inherently contains carbon radicals as a film containing carbon is deposited by plasma due to the operation of plasma CVD. Miyanaga et al. does not explicitly disclose optimal substrate temperatures and plasma densities. However, Miyanaga et al. teaches that the high density plasma depends upon the pressure in the chamber and is optimized for coating efficiency (column 2-3 lines 44-15) and that the concentration of product gas per unit volume, in which the product gas would be recognized to be plasma, may be modified to affect film growth (column 5 lines 55-60). Additionally, Miyanaga et al. teaches that the heating of the substrate, and hence the temperature, depends upon the achievement of a uniform and homogeneous film in view of the applicability of the process to industrial mass production (column 6 lines 53-58). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Miyanaga et al. by routine experimentation to include the claimed plasma densities to ensure efficient film growth and an acceptable growth rate and to include the claimed temperatures in order to achieve a uniform and homogenous film, absent evidence showing criticality for the claimed values.

As to claims 2-4 and 6, the hydrogen concentration in Miyanaga et al. depends upon and is adjusted according to the desired pressure in the chamber and the shape of

the object being coated (as irregular shapes require higher pressure) in column 5 lines 25-60. Therefore, it would have been obvious at the time of the invention to modify Miyanaga et al. by routine experimentation to include the amounts of hydrogen as claimed (and consequently the relative amounts of hydrogen to carbon in the plasma, and vice versa – one of ordinary skill in the art would realize also that these quantities are estimated) in order to adjust the pressure of the chamber and account for all shapes of coated substrates.

As to claim 5, the pulse periods are described in the examples in the claimed ranges and shown in Figures 3A-3C, 4 and 6A-6C.

As to claims 7 and 8, plasma pressures and peak powers are given within the claimed ranges in the examples. Furthermore, plasma pressure and plasma peak power may be modified to adjust film formation rate as discussed above and in column 2-3 lines 44-15 and both are hence result effective variables.

7. Claims 2, 4 and 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow in view of Kawarada et al.

Chow is discussed in paragraph 5 above and includes a method for manufacturing a diamond film using plasma that includes power densities of the film in the range of 600-1000 W/cm^3. Chow does not disclose the range of power density to be from 100 to 250 W/cm^3 or the plasma temperature. Claim 2 of the applicant requires that the power density of the plasma should be from 100 to 250 W/cm^3 and the maximum temperature of the plasma should be between 3500-5000 K in order to

deposit diamond on a substrate. The parameter of power density of the plasma is a result-effective variable as stated by Chow column 5 lines 65-69 and column 6 lines 1-9. Said power densities depend upon the particular apparatus and conditions employed in carrying out the method and the importance of these ranges is that they are sufficient to deposit plasma on the substrate and diamond film. Optimization of this parameter is by routine experimentation and is not inventive. (See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955))

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Chow to include the plasma power density in the range of 100 to 250 W/cm^3 through routine experimentation in order to optimize the power density for particular apparatuses and conditions employed in depositing a diamond film by plasma especially absent evidence showing a criticality for using the claimed power densities.

Chow is silent as to the plasma temperature and H atom concentration and therefore does not explicitly disclose a maximum temperature of the plasma being between 3500 K and 5000 K, the temperature of the plasma less than 1 cm from the substrate being between 1500 K and 3000 K, or the plasma containing hydrogen atoms at the claimed concentrations.

However, Kawarada et al. teaches that the plasma temperature is in the range of 1000-3000 °C and the plasma density of the plasma is within the range of 10^3-10^{16} cm^{-3} in order to deposit a carbonaceous substance such as diamond at a high rate. Therefore, it would have been obvious to have maintained the plasma temperature within a range of 1000-3000 °C, which is both below the claimed maximum temperature

and within the range desired within a cm of the substrate, because doing so would be expected to provide the diamond film on the substrate at a high rate.

Chow and Kawarda et al. are silent as to the H atom concentration in the plasma and C radical concentration in the plasma as required by claims 4, 7 and 8; however, these parameters clearly affect the reaction between hydrogen and methane as these components react to form the diamond film. As such, the H atom and C radical concentrations in the plasma are result effective variables and it would have been obvious to adjust these parameters through routine experimentation to values in the claimed ranges as to optimize the reaction to form diamond, especially absent evidence showing a criticality for using the claimed concentrations.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kelly Stouffer
Examiner
Art Unit 1762

kms

TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER